



Coupling hydrologic and infectious disease models to explain regional differences in schistosomiasis transmission in southwestern China

Author(s): Remais J, Liang S, Spear RC
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Abstract:

Rainfall-runoff models have become essential tools for conceptualizing and predicting the response of hydrologic processes to changing environments, but they have rarely been applied to challenges facing health scientists. Yet with their efficient parameterization and modest data requirements, they hold great promise for epidemiological application. A modeling analysis incorporating simple hydrologic constraints on transmission of the human parasite *Schistosoma japonicum* in southwestern China was conducted by coupling a lumped parameter rainfall-runoff model (IHACRES) with a delay-differential equation schistosomiasis transmission model modified to account for channel flows and on-field egg inactivation. Model predictions of prevalence and infection timing agree with observations in the region, which indicate that hydrological differences between sites can lead to pronounced differences in transmission. Channel flows are shown to be important in determining infection intensity and timing in modeled village populations. In the periodic absence of flow, overall transmission intensity is reduced among all modeled risk groups. However, the influence of hydrologic variability was greater on the cercarial stage of the parasite than the miracidial stage, due to the parasite ova's ability to survive dormant on fields between rain events. The predictive power gained from including hydrological data in epidemiological models can improve risk assessments for environmentally mediated diseases, under both long-term climate change scenarios and near-term weather fluctuations.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Precipitation

Geographic Feature:

resource focuses on specific type of geography

Freshwater

Geographic Location:

resource focuses on specific location

Climate Change and Human Health Literature Portal

Non-United States

Non-United States: Asia

Asian Region/Country: China

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: Schistosomiasis

Mitigation/Adaptation: ☒

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☒

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Outcome Change Prediction

Resource Type: ☒

format or standard characteristic of resource

Research Article

Timescale: ☒

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content